CLAIMS

What is claimed is:

1. A developing unit of an electrophotographic image forming apparatus including a frame and a photoreceptive drum having a center shaft, comprising:

at least one developing apparatus installed on the frame to access and be separated from the photoreceptive drum, and including:

a developing roller developing an electrostatic latent image formed on the photoreceptive drum, and

a gap maintenance member contacting the photoreceptive drum such that the developing roller accesses the photoreceptive drum in a non-contact state while maintaining a predetermined gap with the photoreceptive drum; and

a guide portion formed on the frame to guide a movement of the at least one developing apparatus, the guide portion comprising:

an inclined portion formed on a leading portion of the guide portion to face a center shaft of the photoreceptive drum so that the gap maintenance member contacts the photoreceptive drum while pressing the photoreceptive drum in a radial direction of the photoreceptive drum.

2. The developing unit as claimed in claim 1, further comprising:

a developing roller driving mechanism driving the developing roller.

3. The developing unit as claimed in claim 2, wherein the developing rolling driving mechanism comprises:

a motor;

a first gear having a first shaft rotated by the motor; and

a second gear provided on a rotation shaft of the developing roller, coupled to the first gear when the gap maintenance member contacts the photoreceptive drum, having a second shaft rotated by the motor through the first and second gears, forming a first line connecting the first and second center shafts of the first and second gears, and forming a second line connecting the second center shaft of the second gear and the center shaft of the photoreceptive drum, the first line forming a gear pressure angle of an acute angle with the second line.

4. The developing unit as claimed in claim 3, wherein, when the first gear and the second gear are coupled to each other, the first center shaft of the first gear is disposed between the center shaft of the photoreceptive drum and the second center shaft of the second gear.

5. The developing unit as claimed in claim 3, wherein, when the first gear and the second gear are coupled to each other, the first center shaft of the first gear is disposed at a position opposite to the center shaft of the photoreceptive drum with respect to the second center shaft of the second gear.

6. The developing unit as claimed in claim 2, wherein the developing rolling driving mechanism comprises:

a motor;

a first gear rotated by the motor and having a first center shaft; and

a second gear provided on a rotation shaft of the developing roller, coupled to the first gear when the gap maintenance member contacts the photoreceptive drum, and having a second center shaft, forming a first line connecting center shafts of the first and second gears, and forming a second line connecting the second center shaft of the second gear and the center shaft of the photoreceptive drum, the first and second lines forming an angle within a range between 0° and two times of a gear pressure angle which is formed by the first and second lines so that a gear pressure formed between the first and second gears acts in a tangential direction of the photoreceptive drum.

7. The developing unit as claimed in claim 6, wherein, when the first gear and the second gear are coupled to each other, the first center shaft of the first gear is disposed between the center shaft of the photoreceptive drum and the second center shaft of the second gear.

8. The developing unit as claimed in claim 6, wherein, when the first gear and the second gear are coupled to each other, the first center shaft of the first gear is disposed at a position opposite to the center shaft of the photoreceptive drum with respect to the second center shaft of the second gear.

9. The developing unit as claimed in claim 1, wherein the at least one developing apparatus comprises:

four developing apparatuses having different colors and installed along an outer circumference of the photoreceptive drum in a multi-layer structure.

10. The developing unit as claimed in claim 1, wherein the at least one developing apparatus comprises:

a guide boss provided on a main body of the developing apparatus; and

a bearing member inserted around an end portion of the rotation shaft of the developing roller and inserted in the guide portion to be slidably supported by the guide portion.

11. An electrophotographic image forming apparatus including a charger charging a photoreceptive drum having a center shaft, an exposing unit exposing the charged photoreceptive drum to form an electrostatic latent image, a developing unit developing the electrostatic latent image with toner of a predetermined color, and a transfer unit transferring the developed image to a sheet of paper, wherein the electrophotographic image forming apparatus comprises a frame; and the developing unit comprises:

at least one developing apparatus installed on the frame to access and be separated from the photoreceptive drum, and including a developing roller developing an electrostatic latent image formed on the photoreceptive drum and a gap maintenance member contacting the photoreceptive drum such that the developing roller accesses the photoreceptive drum in a non-contact state while maintaining a predetermined gap with the photoreceptive drum, and

a guide portion formed on the frame to guide a movement of the at least one developing apparatus, and including an inclined portion formed on a leading portion of the guide portion to face a center shaft of the photoreceptive drum so that the gap maintenance member contacts the photoreceptive drum while pressing the photoreceptive drum in a radial direction of the photoreceptive drum.

12. The apparatus as claimed in claim 11, further comprising:

a developing roller driving mechanism driving the developing roller.

13. The apparatus as claimed in claim 12, wherein the developing rolling driving mechanism comprises:

a motor;

a first gear having a first shaft rotated by the motor; and

a second gear provided on a rotation shaft of the developing roller, coupled to the first gear when the gap maintenance member contacts the photoreceptive drum, having a second shaft rotated by the motor through the first and second gears, forming a first line connecting the first and second center shafts of the first and second gears, and forming a second line connecting the second center shaft of the second gear and the center shaft of the photoreceptive drum, the first line forming a gear pressure angle of an acute angle with the second line .

14. The apparatus as claimed in claim 13, wherein, when the first gear and the second gear are coupled to each other, the first center shaft of the first gear is disposed between the center shaft of the photoreceptive drum and the second center shaft of the second gear.

15. The apparatus as claimed in claim 13, wherein, when the first gear and the second gear are coupled to each other, the first center shaft of the first gear is disposed at a position opposite to the center shaft of the photoreceptive drum with respect to the second center shaft of the second gear.

16. The apparatus as claimed in claim 12, wherein the developing rolling driving mechanism comprises:

a motor;

a first gear rotated by the motor and having a first center shaft; and

a second gear provided on a rotation shaft of the developing roller, coupled to the first gear when the gap maintenance member contacts the photoreceptive drum, and having a second center shaft, forming a first line connecting center shafts of the first and second gears, and forming a second line connecting the second center shaft of the second gear and the center shaft of the photoreceptive drum, the first and second lines forming an angle within a range between 0° and two times of a gear pressure angle which is formed by the first and second lines so that a gear pressure formed between the first and second gears acts in a tangential direction of the photoreceptive drum.

17. The apparatus as claimed in claim 16, wherein, when the first gear and the second gear are coupled to each other, the first center shaft of the first gear is disposed

between the center shaft of the photoreceptive drum and the second center shaft of the second gear.

18. The apparatus as claimed in claim 16, wherein, when the first gear and the second gear are coupled to each other, the first center shaft of the first gear is disposed at a position opposite to the center shaft of the photoreceptive drum with respect to the second center shaft of the second gear.

19. The apparatus as claimed in claim 11, wherein the at least one developing apparatus comprises:

four developing apparatuses having different colors and installed along an outer circumference of the photoreceptive drum in a multi-layer structure.

20. The apparatus as claimed in claim 11, wherein the at least one developing apparatus comprises:

a guide boss provided on a main body of the developing apparatus; and

a bearing member inserted around an end portion of the rotation shaft of the developing roller and inserted in the guide portion to be slidably supported by the guide portion .

21. A developing unit of an image forming apparatus including a frame and a photoreceptive drum having a center shaft, comprising:

a plurality of developing apparatuses having a plurality of developing rollers disposed around an outer conferential surface of the photoreceptive drum to develop respective electrostatic latent images formed on the photoreceptive drum with developing agents, respectively; and

a plurality of guide portions guiding corresponding ones of the developing rollers to move toward the photoreceptive drum in a plurality of radial directions of the photoreceptive drum, respectively.

22. The developing unit as claimed in claim 21, wherein the guide portions comprise:

a plurality of linear portions guiding corresponding ones of the developing rollers to move toward the photoreceptive drum in the same direction, respectively; and

a plurality of inclined portions having a plurality of angles with respect to the same direction to guide corresponding ones of the developing rollers to move toward the

photoreceptive drum in corresponding ones of the radial directions of the photoreceptive drum, respectively.

23. The developing unit as claimed in claim 22, wherein each of the developing apparatuses comprises:

a guide boss moving along a corresponding one of the linear portions; and

a member rotatably formed on a corresponding one of the developing rollers to move along a corresponding one of the linear portions and a corresponding one of the inclined portions.

24. The developing unit as claimed in claim 21, further comprising:

a rotation source;

a plurality of driving gears each having a first shaft coupled to the rotation source and rotating by the rotation source; and

a plurality of driven gears each having a second shaft coupled to a corresponding one of the developing rollers and rotating by a corresponding one of the driving gears, respectively.

25, The developing unit as claimed in claim 24, wherein the second shaft of each of the driven gears forms a first line with a center shaft of the photoreceptive drum and a second line with the second shaft of a corresponding one of the driven gears, and the first line is not parallel to the second line.

26. The developing unit as claimed in claim 25, wherein the first line forms an acute angle with the second line.

27. The developing unit as claimed in claim 21, wherein each of the guide portions comprises:

a surface parallel to a corresponding one of the radial directions.

28. The developing unit as claimed in claim 21, wherein each of the guide portions comprises:

a linear portion guiding a corresponding one of the developing rollers to move toward the photoreceptive drum in the same direction; and

a surface extended from the linear portion to push a corresponding one of the

developing roller from the same direction to a corresponding one of the radial directions.

29. A developing unit of an image forming apparatus including a frame and a photoreceptive drum having a center shaft, comprising:

first, second, third, and fourth developing apparatuses, respectively, having first, second, third, and fourth developing rollers disposed around an outer conferential surface of the photoreceptive drum to develop respective electrostatic latent images formed on the photoreceptive drum with developing agents, respectively; and

first, second, third and fourth guide portions, respectively, guiding the first, second, third, and fourth developing rollers to move toward the photoreceptive drum in first, second, third, and fourth radial directions of the photoreceptive drum, respectively.

30. The developing unit as claimed in claim 29, wherein the first, second, third, and fourth radial directions are not the same.

31. The developing unit as claimed in claim 29, wherein the first, second, third and fourth guide portions comprise:

first, second, third, and fourth linear portions guiding the first, second, third, and fourth developing rollers to move toward the photoreceptive drum in the same direction, respectively; and

first, second, third, and fourth inclined portions having first, second, third, and fourth angles with respect to the same direction to guide the first, second, third, and fourth developing rollers to move toward the photoreceptive drum in corresponding ones of the radial directions of the photoreceptive drum, respectively.

32. The developing unit as claimed in claim 31, wherein the first, second, third and fourth inclined angles are not the same.

33. The developing unit as claimed in claim 31, wherein the first and fourth inclined angles are the same, and the second and third fourth inclined angles are the same.

34. The developing unit as claimed in claim 31, wherein the first, second, third, and fourth inclined angles are one of two different angles.

35. The developing unit as claimed in claim 31, wherein each of the first, second, third, and fourth developing apparatuses comprises:

a guide boss moving along a corresponding one of the first, second, third, and fourth linear portions; and

a member rotatably formed on a corresponding one of the first, second, third, and fourth rollers to move along a corresponding one of the first, second, third, and fourth linear portions and a corresponding one of the first, second, third, and fourth inclined portions.

36. The developing unit as claimed in claim 35, further comprising:

a door rotatably coupled to the frame to open and close the developing unit disposed in the frame; and

first, second, third, and fourth elastic members coupled between the door and corresponding ones of the first, second, third, and fourth developing apparatuses, respectively.

37. The developing unit as claimed in claim 36, wherein the member of each of the first, second, third, and fourth developing apparatuses moves along the corresponding one of the first, second, third, and fourth inclined portions when the door is closed and opened.

38. The developing unit as claimed in claim 31, further comprising:

a rotation source;

first, second, third, and fourth driving gears each having a first shaft coupled to the rotation source and rotating by the rotation source; and

first, second, third, and fourth driven gears each having a second shaft coupled to a corresponding one of the first, second, third, and fourth developing rollers and rotating by a corresponding one of the first, second, third, and fourth driving gears, respectively.

39, The developing unit as claimed in claim 38, wherein the second shaft of each of the first, second, third, and fourth driven gears forms a first line with a center shaft of the photoreceptive drum and a second line with the second shaft of each of the first, second, third, and fourth driven gears, and the first line is not parallel to the second line.

40. The developing unit as claimed in claim 38, wherein the first line forms an acute angle with the second line.

41. The developing unit as claimed in claim 38, wherein the second shaft is disposed between the first shaft and the center shaft of the photoreceptive drum.

42. The developing unit as claimed in claim 38, wherein the first shaft is disposed between the second shaft and the center shaft of the photoreceptive drum.

43. The developing unit as claimed in claim 38, wherein the photoreceptive drum has a radius, and a distance between the second shaft and the center shaft of the photoreceptive drum is shorter than the radius.

44. The developing unit as claimed in claim 38, wherein the photoreceptive drum rotates in a first rotation direction, and the second shaft is disposed in a direction opposite to the first direction with respect to the first line.

45. A developing unit of an image forming apparatus including a frame, a developing unit main body, and a developing roller having a rotation shaft comprising:

a guide portion formed on the frame;

a guide boss formed on the developing unit main body and slidably inserted into the guide portion; and

a bearing member rotatably supporting the rotation shaft of the developing roller and rotatably inserted into the guide portion.

46. A developing unit of an image forming apparatus including a frame, a developing unit main body movably disposed on the frame, a developing roller having a rotation shaft, and a photoreceptive drum, comprising:

a motor;

a first gear coupled to the motor; and

a second gear formed on one end of the rotation shaft of the developing roller, and disposed to contact the first gear selectively according to a movement of the developing main body.